URBAN DENSITIES AND TRANSIT: AN ANALYSIS OF CAPE TOWN'S INTEGRATED RAPID TRANSIT SYSTEM FROM 2010 – 2016 WITH SPECIFIC FOCUS ON THE WESTERN CORRIDOR

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AUTHOR'S DECLARATION

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ABSTRACT

The density of urban development plays a prominent role in the successful functioning of any public transport system. The MyCiti Bus System was implemented by the City of Cape Town in 2010 with a view of relieving traffic congestion resulting from over-dependence on private vehicles. Changes in population and land uses around MyCiti stations along the Western Corridor of the bus system were analysed to identify if density changes have occurred since the implementation of the system that can assist it in becoming more effective. The changes have not been significant but this can possibly be attributed to the relatively limited time-span since its inception, however, the research identified factors that are actively hindering the densification around these stations. The City needed to be more pro-active with the implementation of the MyCiti system to ensure higher density development. The low-density development that is evident in Cape Town is not ideal for the MyCiti system but provides an opportunity for the City to respond with appropriate land use and development programmes to ensure the success of the transport system.

Keywords and phrases: Urban densities; public transport; MyCiti IRT system; population density; building density; land use intensification.

OPSOMMING

Die digtheid van stedelike ontwikkeling speel ‘n prominente rol in die suksesvolle funksionering van enige openbare vervoerstelsel. Die MyCiti Bus Sisteem was geïmplementeer deur die Stad Kaapstad in 2010 met die doel om verkeersopeenhopings as ‘n resultaat van afhanklikheid op privaatvervoer te verlig. Veranderinge in die bevolking en grondgebruik rondom MyCiti stasies in die Westelike Korridor was ontleed om digtheidsveranderinge, wat vanaf die implementering van die sisteem plaasgevind het, te identifiseer. Hierdie verandering was nog nie beduidend nie, omdat dit moontlik toegeskryf kan word aan die relatiewe beperkte tydsperiode vanaf die ontstaan van hierdie sisteem. Die navorsing het egter ook faktore geïdentifiseer wat die verdigting rondom hierdie stasies aktief verhinder. Die Stad Kaapstad moet meer pro-aktief wees met die implementerig van die MyCiti sisteem sodat hoër digtheidsontwikkeling verseker kan word. Die duidelike lae digtheidsontwikkeling in Kaapstad is nie ideaal vir die MyCiti sisteem nie, maar bied ‘n geleentheid vir die Stad om te reageer met die toepaslike grondgebruik- en ontwikkelingsprogramme om sodoende die sukses van die vervoerstelsel te verseker.

Trefwoorde en frases: Stedelike dightheid; openbare vervoer; MyCiti BRT sisteem; bevolkingsdigtheid; geboudigtheid; grondgebruik ontwikkeling.

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SECTION 1: INTRODUCTION

1.1. BACKGROUND

Cape Town is a metropolitan municipality which covers an area of 2 487km². The 2011 national Census reported that there are currently 3.74 million people residing in the metropolitan area with the highest densities in the Metro South East, which consists of Mitchells Plain, Khayelitsha, and Langa (City of Cape Town 2013). There are 1 128 808 vehicles registered in the City of which 24 709 are minibuses and 3 866 are buses. This leaves a total of 1 100 233 vehicles that makes use of the Cape Town Metropolitan roads, thus leading to major congestion problems in and around the city (City of Cape Town 2013). A variety of public transport modes are being utilised in the area including the Metrorail, minibus taxi's, the Integrated Rapid Transit (IRT) System and also private taxi's, to only name a few. Cape Town spends more than double the amount on transport subsidies than on housing. Most recently an amount of R696 236 000 was allocated to the Western Cape Department of Transport to subsidise public transport services (Future Cape Town Summit 2013).

The density of urban development plays a prominent role in the successful functioning of any public transport system and it is necessary to understand how this relationship influences the current functioning of the MyCiti Bus service operating in the City of Cape Town (see Cervero & Guerra 2011 and City of Cape Town 2012b). The MyCiti service launched its first network in May 2011, but before this some of the routes were utilised for the Soccer World Cup that took place in 2010 (MyCiti 2016). The urban layout of Cape Town is currently characterised by relatively low density development especially towards the suburban areas in the North-east and North-west of the City from which many people commute daily to the Central Business District (CBD) for work. The African Green City Index, which evaluated 15 African cities, including capital cities and leading business centres, found that aside from Pretoria, Cape Town is the least densely populated at 1,500 persons/km² (Economic Intelligence Unit 2012). The long distance that must be travelled by people daily creates a major need for efficient public transport. With systems such as the MyCiti Bus in place, the question arises as to whether public transport is having a notable impact on reducing congestion and how the urban fabric of Cape Town contributes to this.

Land uses surrounding public transport infrastructure are usually influenced by newly established public transport systems however according to Grey & Behrens (2013) it is improbable to occur instantly following the construction of public transport systems. The land use response to Cape Town's MyCiti BRT (Bus Rapid Transit)-service has so far shown little change (Grey & Behrens

2013). This study will focus on the influence that the MyCiti routes were expected to have on surrounding land uses as well as changes in population and building density as a means to measure this influence to date.

SECTION 2: RESEARCH PROBLEM

2.1. PROBLEM STATEMENT

The IRT system or MyCiti Bus system as it is referred to was implemented in 2010 but only a few temporary routes were then being used. There is currently a total of 44 routes that are being utilised. Of the total of 2 527 531 people that make use of public transport in Cape Town daily, which is approximately 68% of the city's population (StatsSA 2014), only 1% make use of the MyCiti Bus services (City of Cape Town 2013). This study intends to understand the reasons for the low levels of usage of the MyCiti services by researching the land use intensification around MyCiti stations that could contribute to increased usage of the system, especially since the service consumed massive capital investment from the City of Cape Town's budget. The urban fabric and density of a city is one of the aspects that strongly influence the successful functioning of public transport as well as the efficiency thereof. Higher densities can be associated with higher levels of transit service, higher parking costs and also lower car ownership rates. It is noted that density is not the only factor that causes these things but sometimes rather a substitution for a host of other economic-related factors that does affect travel behaviour (Frank & Pivo 1994). However, it is important to analyse the changes in density and intensity of the urban areas in Cape Town situated adjacent to the MyCiti routes and stations as this could provide some explanation for its underutilisation. Surrounding land uses usually responds to newly initiated public transport infrastructure as noted by Grey and Behrens (2013).

The study therefor aims to investigate the changes in population- and building density of areas surrounding these MyCiti bus service routes since its inception as a way of understanding its underutilisation. The study will also consider possible reasons for the limited changes in land development witnessed around the MyCiti stations. The timeframe that will be used for this study will stretch from 2010, when the services were used for the first time until 2016. The focus of the study will be on the Western Corridor, as this is the first routes that was established and utilised in 2010 (MyCiti 2016). The study will also consider to what extent the City of Cape Town municipality's spatial planning policy was pro-active in enabling or facilitating higher densities or intensification of activities at these points by looking at the Spatial Development Framework (SDF) of Cape Town. The system is still quite new but the analysis could already reveal initial responses.

2.2. AIM AND OBJECTIVES

The aim of the study is to investigate the changes in population- and building density of areas that is surrounding the MyCiti bus service route along the Western Corridor as a way of understanding its underutilisation. The study will also consider possible reasons for the limited changes in land development witnessed around the MyCiti stations. This aim will be researched by focussing on the following research objectives.

To realise this aim, seven objectives are pursued, namely:

1. Identify the specific MyCiti bus stations along the Western Corridor.
2. Map the spatial distribution of these MyCiti bus stations.
3. Ascertain the City of Cape Town's policy position regarding the directives for land development surrounding the MyCiti stations
4. Establish the historic and current population density around the MyCiti bus stations.
5. Determine the historic and current building density trends around the MyCiti bus stations.
6. Analyse the changes that have occurred in these areas and identify the reasons therefor.
7. Identify possible limiting factors that contributes to the slow response by surrounding land uses adjacent to the MyCiti stations.

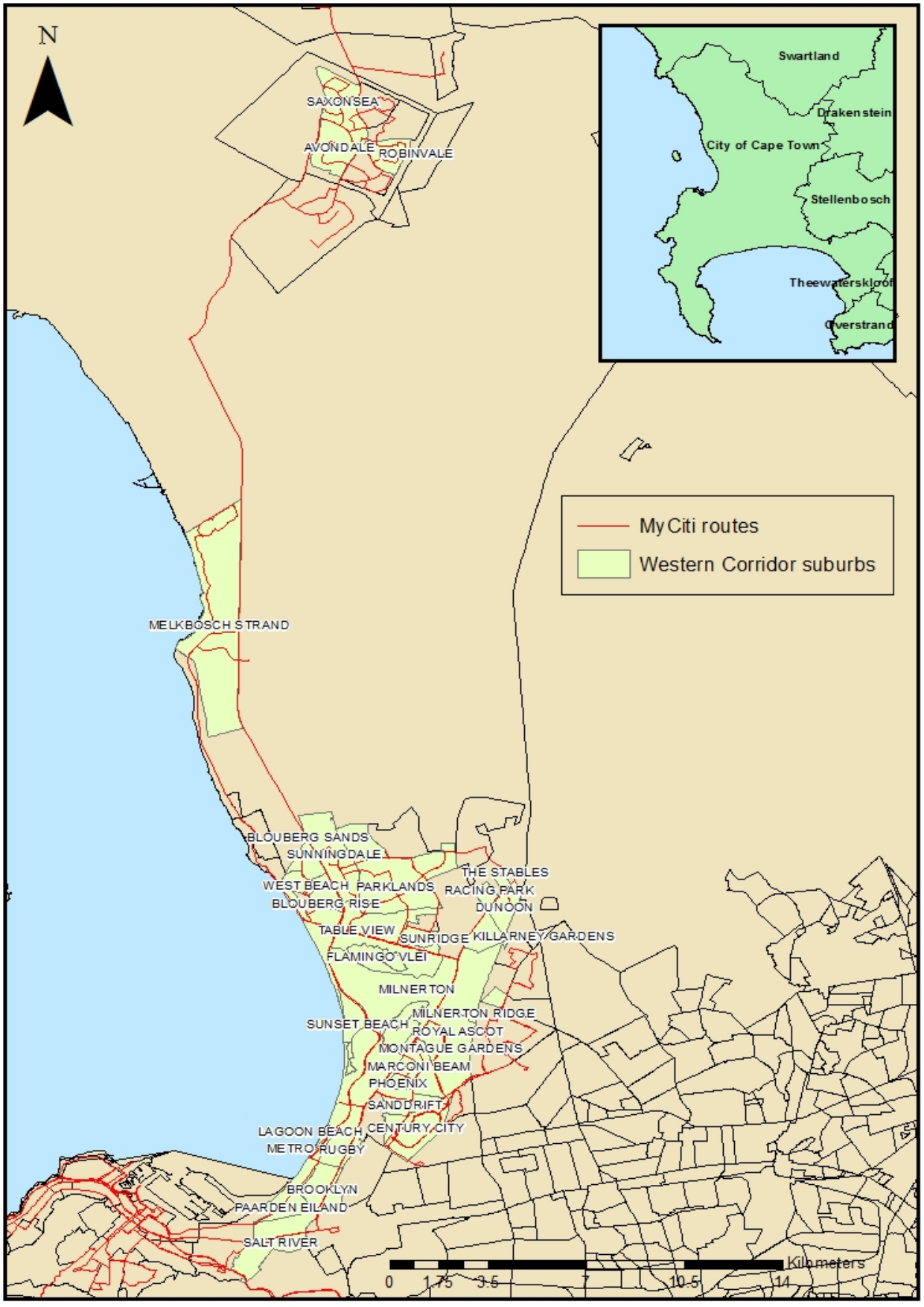
2.3. HYPOTHESIS

The urban layout and low densities that were historically present along the MyCiti route on the Western Corridor were too low a threshold to effectively operate the MyCiti Bus Service that have been implemented. These densities have persisted with little to no visible changes taking place over a six-year period. The City of Cape Town needed to be more pro-active in its planning and execution of the MyCiti bus service to pro-actively enable and retrofitting higher densities and intensification of land uses along the MyCiti route. Steps will need to be taken retrospectively to intensify the use of land around the MyCiti routes and stations to bring more people closer to the service and enable more efficient usage thereof.

2.4. STUDY AREA

The MyCiti service is planned to supply the entire city of public transport. But this goal will probably only be reached by 2030. The first phase of the system that was implemented was along the Western Corridor of Cape Town. For the purpose of this study, investigating the MyCiti system

in its entirety, would be too large of a project thus the focus of the study is on the Western Corridor including: Avondale, Blouberg Rise, Blouberg Sands, Brooklyn, Century City, Dunoon, Flamingo Vlei, Joe Slovo Park, Killarney Gardens, Lagoon Beach, Marconi Beam, Melkbosstrand, Metro, Milnerton, Milnerton Ridge, Montague Gardens, Paarden Eiland, Parklands, Phoenix, Racing Park, Robinvale, Royal Ascot, Rugby, Salt River, Sanddrift, Saxon Sea, Sunningdale, Sunridge, Sunset Beach, Table View, The Stables and West Beach (Figure 1).



Source: MyCiti (2016)

Figure 1 The study area: Western Corridor suburbs

SECTION 3: LITERATURE REVIEW

3.1. INTRODUCTION

The density and urban layout of a city plays a major role in the transit modes that are used by commuters within these cities. It will also determine whether certain modes of transport are efficient and successful (Frank & Pivo 1994). Studying the urban layout and density of Cape Town will shed light on whether it has an impact on the public transport modes in the city as well as the efficiency and utilisation thereof. This study will focus specifically on the Integrated Rapid Transit System which was launched in Cape Town in 2011 known as the MyCiti Service. The MyCiti system is expanding as funds become available but it is already quite widespread and thus too large for this study. The study will focus on the Western Corridor as it were the first routes that was launched and has been used for the longest period of time since the inception of the system in 2010 (MyCiti 2016). It will yield the most useful results in terms of analysing possible densification that have place over time. The study aims to investigate the changes in population- and building density of areas that is surrounding these MyCiti bus service routes since its inception as a way of understanding its underutilisation.

3.2. BUS RAPID TRANSIT (BRT)

BRT is refined bus systems that have their own lanes on city streets. These systems make use of bus stations instead of bus stops. This ensures that passengers pay before they board the bus. The use of bus stations instead of bus stops are leading to more orderly boarding which is similar to metro and light rail systems. BRT systems are seen as safer, faster and more efficient than traditional bus systems (Suzuki, Cervero & Iuchi 2013). BRT has grown as a potentially cost-effective form of high-capacity transit. This is especially true in small to medium-size cities which do not have high enough densities or serious enough peak-period traffic congestion to justify more expensive transit investment (Cervero & Guerra 2011). Suzuki et al. (2013) is also of opinion that many cities are now choosing to make use of BRT systems because of the cost and convenience. BRT systems are usually implemented in cities with populations that exceed 700 000 people and where rail services are also operational (Levinson et al. 2003). The goal of BRT systems is to offer similar service quality as rail-transit but with the cost savings and flexibility of bus transit. An example of the successful implementation of a BRT system is in Brazil. Brazil was well-known for its bus schemes, especially by the end of the 1970’s. One of the main reasons that Brazil started with the implementation of BRT systems was because it can deliver high-quality mass transit even in areas

where municipalities are seen as low income municipalities (Lindau et al. 2007). Land development is said to be a benefit that is linked to the establishment of these BRT systems. In Pittsburgh the East Busway resulted in $302 million in new and upgraded development. A study was done on The Martin Luther King, Jr. East Busway, which is part of the BRT system in Pittsburgh, and found that property prices decreased the further it was located from the BRT stations (Tann et al. 2009). In Brisbane the South East Busway lead to property prices growing by 20% (Levinson et al. 2003). In cities such as Brisbane, Ottawa, Curitiba and Pittsburgh benefits in land use development were experienced, similar to those experienced around rail lines. An example is the impact that the new landscaping that accompanies the development of the BRT system has on the image of the area. This is a critical step to more development taking place in an area (Tann et al. 2009). A very essential factor that must be taken into account when developing BRT systems, is adequate parking surrounding these stations (Levinson et al. 2003). This will ensure that the service is commuter-friendly as users do not have to struggle with issues such as parking when making use of the service.

3.3. THE RELATIONSHIP BETWEEN URBAN FORM AND PUBLIC TRANSPORT

Contained, compact urban layouts with a mix of uses in close proximity are said to strengthen public transport because these forms support high population densities. This form of development also encourages cycling and walking and people are more likely to make use of local services and facilities (Williams 2005). The growing presence of private automobiles influences the way that people move around cities but also how cities are developing and forming. When the built form of a city is automobile-oriented, it usually is characterized by spread-out development, non-contiguous land uses, strip development and large city blocks that are unfriendly for pedestrians. Automobile dependent cities can lead to people who cannot afford cars to live on the outer edges of cities where there are limited basic services and jobs. The transit that might be available will be expensive as it is situated far away from the services that need to be reached. Transit-oriented development (TOD) is one way in which the dependency on cars can be lessened. It can increase the ridership of public transit by drawing more travellers out of their cars and into busses and trams and it can also serve as a hub for uplifting long-distressed urban districts. TOD is characterized by two main features: Its proximity to the transit stations and terminals and the service provision of high-quality public transit (this can include underground trains, BRT systems etc.) and compact, mixed-use neighbourhoods and buildings that encourage walking, cycling and making use of public transit. TOD is most successful in compact developed cities (Suzuki, Cervero & Iuchi 2013).

Some of the factors that contribute to public transport problems include the rapid growth in population, the low standards of efficiency, reliability and safety of public transport, the shortage of funding and the poor enforcement of regulations. In many cases public transport is lacking quality and capacity (Iles 2005).

3.3.1. BRT system in Curitiba, Brazil

The BRT system in Curitiba was the first full BRT system in the world. Curitiba is one of the best examples of integrated transportation and land use development. In 1965, when planning was underway for the system, a new Master Plan was developed which stated that Curitiba would no longer grow in all directions, but rather grow along designated corridors in a linear form. This was encouraged by land use policies and zoning which promoted high density residential and industrial development along the corridors (Goodman et al. 2005). Between 1972 and 1988 plans were executed to initiate a city wide integrated bus transit system. The Integrated Transit Network (RIT) provides the backbone of the TOD initiative through low cost and high impact interventions. The City makes use of a trinary system, which achieves successful linear TOD (Lindau et al. 2010).

The Master Plan of Curitiba limits central area growth while encouraging commercial growth along the transport arteries radiating out from the city centre. Other policies also contribute to the success of the transit system. Land within two blocks of the transit routes are zoned for high density. This creates more transit ridership per square meter. Beyond the two blocks, zoned residential densities change in proportion to distance from the routes. The planners channel new retail growth to transit corridors and limited public parking is available in the downtown area. The use of the transport systems is also encourages by employers offering transportation subsidies, especially to low-skilled and low-paid employees (Goodman et al. 2005).

3.4. THE RELATIONSHIP BETWEEN DENSITY AND PUBLIC TRANSPORT

Density is a term that is difficult to define, as it is a very complex concept with a variety of types that falls under it. Different nations and professions have different approaches to the concept (Dempsey et al. 2012). Defining density is also dependent on the kind of density that is being studied for example dwelling, people or urban (Boyko & Cooper 2011). A simple definition of density is simply the number of units in a given area (Boyko & Cooper 2011). This simple definition focusses mostly on density when looking at it in a spatial sense. Density can also be defined as a numerical measure of the number of people residing, or the level of building development in an area (Cheng 2010). Average density is one simple characterization of urban

form, even though it is very hard to measure consistently. It is used to discover disparities in density in cities and also identifies the differences in land-use patterns and design between places with the same density (Handy 1996). Density is a very important concept when it comes to architecture, planning and urban design (Rapoport 1975). This is because it can be used to describe, forecast and control the use of land (Berghauser Pont & Haupt 2007; DETR 1998). Density is shaped by a variety of factors. This includes the age of the city, culture, history, geography, context, policies and economy (Smith 1984). It is also shaped by the interest over resource use, the increase in environmental awareness and thus the need to reduce car travel (DETR 1998). Density is also said to play a key role in sustainable development. It can lead to the development of more holistic communities which includes better transportation, a strong economy and affordable housing (Boyko & Cooper 2011).

Two of the main density types include residential and building density (Jenks & Jones 2010; Ng 2009). Measuring these different density types can be done in various ways for example residential density can be described as the number of dwellings, rooms or bedspaces per hectare or square kilometre, whereas building density will rather be referred to as the plot area or the ratio of open to built-up space (DETR 1998; Forsyth 2003). Residential density is regularly used as a sprawl indicator (Ewing et al. 2003).

There are many different views on whether higher densities or lower densities are more beneficial to urban development. This is especially in terms of mobility and transit. The mobility advantages that are associated with higher urban densities include the reduction of fossil fuel emissions and also the carbon footprint of cities. This is because things are physically located closer to one another, meaning that certain resources can be shared (Boyko & Cooper 2011). Higher densities can be associated with higher levels of transit service, higher parking costs and also lower car ownership rates. It is however important to note that density is not always the factor that causes these things but sometimes rather a substitution for a host of other economic-related factors that does affect travel behaviour (Frank & Pivo 1994). Dempsey et al. (2012) also found that residents in denser neighbourhoods are more likely to make use of local services and facilities than those that live in lower-density areas. They are also less likely to own or use a car to make use of facilities and services. When there are more people located in a tightly packed urban area, people can move around more efficiently in ways that do not require private vehicles. Cycling and walking can lead to health benefits and living and working in areas of higher densities means that people have better access to services and facilities, giving more access to a larger group of people (Boyko & Cooper 2011).

The relationship between density and successful public transport is critical in terms of achieving an efficiency in urban areas. Fairly dense urban development is essential to an effective public transport system. Increasing urban densities will give public transport a more stable financial foot to stand on (Cervero & Guerra 2011). Population and employment densities are said to have the largest impact on travel behaviour (Alexander & Tomalty 2002). Meyer, Kain and Wohl found in 1965 that nothing is so beneficial to the relative economy of rail transit as high volumes and population density. Even though their study was focussed on rail transit, it is still applicable to the relationship between density and transit. The ridership and capital costs will usually rise with job and population densities, but the increased ridership more than balances out the increased costs (Cervero & Guerra 2011). In high-density cities, Burton (2000) found that the higher the net population density, the bigger the chances are that disadvantaged groups will make use of public transportation, but in low-density cities, disadvantaged groups are more likely to cycle or walk to work. Higher urban densities also reduce car use and energy consumption (Brownstone & Golob 2009). As density increases, it is also noted that households who own one or more vehicles will produce fewer trips where zero-car households will produce more trips (Deutschman & Jaschnik 1968). Newman and Kenworthy (1999) hypothesized that building residential developments around public transport nodes would encourage the individuals to rather use the public transport instead of their private vehicles. There are however also negative outcomes related to higher densities which include the rise in pedestrian casualties (Graham & Glaister 2003) as well as higher levels of congestion (Schwanen, Dieleman & Dijst 2004).

Standards for density thresholds have been developed that can give guidance to planners about how to plan for density to support public transport. An example of where this can be found is in the Guidelines for Human Settlement Planning and Design, which is compiled by the CSIR and the Department of Housing (Republic of South Africa 2000). For the case of South African cities, corridor development is mostly advised. Higher density is necessary to lead to more efficient public transport networks. Unused or under-utilised land within the corridor structure must be used for higher-density development as higher densities are more beneficial to public transport systems. In general, as residential and employment densities increase, so do the number of passengers per kilometre along the route also increase, justifying more frequent or higher levels of public transport service. This helps to make public transport much more attractive. Scattered travel patterns should be avoided so that public transport reflects movement towards a single centre (Republic of South Africa 2000).

Cervero and Gorham (1995) found that when development is being planned and when looking at the development in terms of density, the focus cannot only be put on the character of the

neighbourhood, but it must be put on the character of the larger region in which the neighbourhood is situated. The development must occur in such a manner as to minimize the dependency on automobile travel. The investment that is necessary in public transport systems are usually high and one way to ensure more cost-effectiveness is to increase density around existing stations. The need also exists to increase job opportunities located close to the stations, as this will increase the ridership of the public transportation systems (Cervero & Guerra 2011). One way that density is being increased in cities, is through urban consolidation. This is done by increasing densities within the current urban footprint, especially residential densities (Holloway 2008).

3.5. PUBLIC TRANSPORT IN SOUTH AFRICA

South African cities have been shaped by modernist-planning paradigms and Apartheid policies that led to segregated development that is still very visible in many South African cities. These cities have thus been left with highly inefficient urban form. The inefficiency refers to cities that are experiencing segregation, sprawl and fragmentation (Dewar, Louw & Povall 2012). One of the major consequences of this urban form is densities that are far too low to support viable and efficient public transport (Dewar 2011). Public transport management have experienced its fair share of change and transformation. After 1994 many policies and documents were developed to reverse this inefficient urban form. These included the following: SDF's, IDP's, National Land Transport Strategic Framework, Urban Transport Act, Road Traffic Act, National Road Traffic Act, a Transport Appeal Tribunal, Cross-border Transport Agency, the various White Papers on Transport Policy and the Transport Framework Revision Act in the various provinces. One of the main contributors to the change is the changing needs of commuters (Hanyane 2011).

The South African public transport industry consists of three main modes of transport: the traditional commuter rail system and the new Gautrain high-speed rail between Johannesburg, Tshwane (Pretoria) and the Oliver Tambo International Airport; the subsidised and unsubsidised commuter bus industry, including the two bus rapid transit (BRT) systems in Cape Town and Johannesburg and a growing 16-seat minibus taxi industry (Walters 2014). Johannesburg's BRT system, the Rea Vaya BRT system, was the first of its kind in South Africa, with the Gautrain following close on its heels. The Rea Vaya BRT system was launched in 2009 (ReaVaya 2016) and the Gautrain in 2010. The Rea Vaya BRT system was expected to not be as successful as it currently is, as previous interventions between government and the minibus-taxi industry have proved to cause many problems (Venter 2013). It was hoped that people would use a combination of the Gautrain and the Rea Vaya services, but this has not been the case. This is mostly due to the

significant difference in fares. The SDF of Johannesburg initiated various strategies to restructure the fragmented form of the city. These included the aim to attract new development surrounding public transport infrastructure, increasing densification at strategic locations and supporting an efficient movement system. The city has been yielding results as the overall density of Johannesburg has improved to 2698 persons/km² in 2011 compared to 1962 persons/km² in 2001. Public Transport Management Areas (PTMA) are also another very important strategy that have been introduced. These areas are prioritised for investment and are linked to land use management frameworks and incentives that will aid its attractiveness for development. Almost all commercial, office and industrial applications take place within the PTMA in the northern part of the city. It has however been noted that investment along the BRT routes in Johannesburg is not as intensive as along the Gautrain routes (City of Johannesburg 2013).

An example of a strategy that was initiated to support the transport problems that exist due to the urban form of cities is the Gauteng Growth and Development Strategy (GGDS). It is a programme that focusses on addressing the transport problems such as congestion, reducing the use of automobile transport and the affordability of public transport (Hanyane 2011).

3.6. THE URBAN DEVELOPMENT PATTERN IN CAPE TOWN

Cape Town has inherited and is struggling with the impacts of apartheid spatial planning. The movement and settlement of non-white people were regulated in urban areas and this led to them being pushed to the peripheries of urban areas. The city has grown in a low-density manner over the past 20 years. From 1985 to 2005, the developed area of the city has increased by 40%, while in terms of the population it has increased with 700 000 people between 1996 and 2006 (Future Cape Town Summit 2013). According to a study done by the African Green City Index, which evaluated 15 African cities, Cape Town is aside from Pretoria, the least densely populated city with 1500 persons/km² (Economic Intelligence Unit 2012). The economic geography of the city has changed and is still changing to a more dispersed and decentralised structure. Office and retail activities are shifting from the city core to suburban areas and to office and retail parks along major freeways. The functions of the CBD are thus changing towards tourism and entertainment activities as well as retailing that is focussed more on the lower income consumers. This form of development is also increasing the contrast between rich and poor areas as most job creation and investment is taking place in close proximity to the more prosperous suburbs. But these areas are not being served as well by public transport such as the commuter rail and bus services. This leads to these more affluent areas experiencing more low-density development which is mostly car-oriented.

Decentralisation is thus accelerating leading to property investments mostly taking place in outlying centres. Areas such as the Cape Flats and Atlantis are lower-income areas that are located on the peripheral areas of Cape Town. The pattern of metropolitan land-use is acting as a barrier to provide good public transport systems to areas such as these. There is a very large movement of commuters that is necessary daily as 80% of all formal jobs are located in the CBD and the northern and southern suburbs, but only 37% of the population live in these areas. The increase of new low-income housing that is being situated in the outskirt areas of the city, with the job opportunities increasing in the wealthier northern areas, mean that the need for commuting and also the commuting distances are increasing (Turok & Watson 2001).

The low-density development in Cape Town has created challenges. These challenges are as follows: Long travel distances with dispersed urban activity patterns, which is making it difficult to create a practical public transport system, road-based transport has environmental pollution consequences, agricultural land on the outskirts of urban areas are being used for urban development, the cost of providing the necessary infrastructure to service low-density areas is much greater than for higher density areas and then there is also the economic implications that goes hand in hand with the fact that all people do not have access to services etc. as they are too far away (City of Cape Town 2012b).

There are three arguments for higher densities in Cape Town: To create a more sustainable city in the future in terms of environmental and financial factors, to promote economic growth and employment through closer proximity between firms and to support economic and social inclusion by improving access to opportunities (Turok 2009).

3.7. PUBLIC TRANSPORT IN CAPE TOWN

The development of public transport in South Africa and thus also in Cape Town has been the product of past apartheid settlement strategies as mentioned earlier. Rail and bus infrastructure were used to link the formerly disadvantaged residential areas to the areas of employment and services. It is because of this that public transport in South Africa is seen as a poor person’s utility. There are a few issues that arise in terms of public transport in the Cape Metropolitan Area (CMA): The high levels of unemployment means that there is a large portion of the population that is dependent on public transport to access education, employment etc., it is mainly the minibus-taxi services that can adhere to the mobility needs of the unemployment sector and the major difference between the rich

and poor forms a fractured market with very different needs when it comes to public transport (Clark & Crous 2002).

Cape Town faces massive challenges in terms of population growth, urban sprawl and low-density residential development. Urban sprawl and low-density development are conditions that are not favourable to the development of public transport networks (Dewar 2011). The city is thus in need of a public transport system that can encourage development, especially higher density development. But the issue is whether the city can host such a transport system, because of the low-density development and the urban sprawl. The City of Cape Town does plan for public transport in the CTSDF and the District Plans as well as for the need for higher-density development, to assist public transport systems (City of Cape Town 2012a).

3.7.1. Bus rapid transit system in Cape Town: The MyCiti System

The above mentioned problems thus showed that an urgent plan was necessary in Cape Town in terms of public transport. The quality of the public transport services that are available in South Africa was also mostly inadequate (Republic of South Africa 2005). Improvements in public transport services are also necessary to decrease the dependency on automobiles which is causing major congestion in the Cape Metropolitan Area (Grey & Behrens 2013). A bus rapid transit system was thus chosen as a way to approach these major problems. The vision behind the system is to allow Capetonians to be able to travel across the metropolitan area in a quick, safe and comfortable manner. Once it is completed, it will be the biggest project that the City of Cape Town has ever undertaken. A large part of the funding has come from the Public Transport Infrastructure and Systems Grant at the national department of Transport (IMIESA 2011).

Before the system was officially launched, elements of it were used during the 2010 FIFA World Cup. This included services to the Cape Town Stadium, to the airport and a temporary service around the city (MyCiti 2016). Phase 1a of the BRT system started operating in May 2011 (Grey & Behrens 2013). The first route that was launched was between Cape Town and Table View. This is known as the West Coast Corridor. The main reason that this was the first route to be launched was because there is no passenger train service on this route and the traffic congestion was in a worsening state (IMIESA 2011). The system is however one that underutilization has been planned for, especially in the early stages. The estimated annual recurring operating deficit was R255 million in 2012/13 and R318 million by 2015/16 for phase 1a. The underutilisation is blamed on the unbalanced passenger flows during the peak periods, which then means that the busses are very empty when returning. In the West Coast Corridor, the density and distribution of the population is also said to be too low to ensure satisfactory peak hour travel demand. This thus means that

increases in the intensity of development are necessary in these areas to ensure maximum utilisation of the phase 1a system (Grey & Behrens 2013). Phase 1a also extends to Atlantis, Melkbosstrand, Du Noon, Blaauwberg, Montague Gardens and Century City. And it includes the services in Central Cape Town that travels to the Waterfront, Gardens and up and down Long and Loop streets (IMIESA 2011). The second phase extends to the more southern parts of the metropolitan including Mitchells Plain, Khayelitsha and other parts of the peninsula. It is planned that the third phase will include routes to Bellville, the rest of the northern suburbs and Stellenbosch and then the fourth phase the Greater Helderberg Area (MyCiti 2016). The entire project is expected to take 20 years to complete. When the whole service is in working order, the goal is that 75% of Cape Town's population will be able to make use of the service being in a 500m radius of a bus station (IMIESA 2011).

3.8. CONCLUSION

The literature that was researched, gave an oversight of the various topics that this study is focussing on. It found that BRT systems are successful even in low income municipalities and determined that this could be one of the reasons that a BRT system was chosen for Cape Town. The various transport problems that are being faced in Cape Town were also determined as well as the impact that apartheid spatial planning has had on the layout of the city and how this affects the transport system. Focus was also put on density and whether higher or lower density is more beneficial for transport systems. The literature found that there are more mobility advantages with higher density. Cape Town has been identified as having low density development and thus the various challenges that are created by low density were also identified. One of these problems is the fact that 80% of jobs are located in the CBD but only 37% of Cape Town's population lives here, leading to a very large number of transit that is necessary every day. The reasons for implementing the MyCiti system in the Western Corridor first are also identified as well as the underutilisation of the system.

SECTION 4: METHODOLOGY

As a general background to understanding the influence of public transport systems on surrounding land uses a literature review was conducted to aid the study in achieving its primary aims. Further data was collected employing a mixed-method research methodology drawing on quantitative and qualitative information. This included data in the form of statistics and also information collected from policies and personal discussions that are relevant to density and transport in Cape Town.

The first and second aims of the study relates to the identification and mapping of the specific MyCiti stations along the Western Corridor. This information was retrieved from the MyCiti website. The various stations are available on the website and from there the MyCiti stations were identified which focus would be on in this study. The Western Corridor was chosen as the study area, which was the first phase of the MyCiti system that was implemented. The spatial distribution of the stations in this area was then mapped using ArcGIS, to give a clear indication of where they are located and the spatial relations between the different stations.

The third aim of the research is to ascertain the City of Cape Town's policy position regarding the directives for future land development around the MyCiti infrastructure. This was done via a desktop study involving a thorough analysis of the City's Spatial Development Framework. In addition, an in-depth interview was conducted with an official from the City's Department of Spatial Planning and Urban Design who is knowledgeable on land development in the study area. This discussion also assisted in achieving the fifth aim of the research relating specifically to the historical and current development trends in the areas surrounding the MyCiti bus stations that form part of this study. It was revealed during this interview that the changes in building density would not have occurred on a scale that would be visible on aerial photographs. The fifth aim was also achieved by quantitative research. The estimated growth in formal dwelling units in the various suburbs between 2011 and 2015 were studied as part of reaching this aim.

The largest part of quantitative research in this study was conducted to achieve the fourth aim of the study i.e. to establish the historical and current population densities around the MyCiti stations under consideration. The population statistics were studied to indicate whether or not there were an increase or decrease in the population of these areas where the BRT system have been in working order for six years.

An informal discussion was also conducted with a Senior Professional Officer from the Development Information and GIS Department of the City of Cape Town, where information regarding the quantitative aspect of the study was collected (Table 1). The sixth and seventh

objectives were also achieved through the interview that was conducted however the quantitative research also contributed to these objectives. As research was conducted continuously throughout the process of the study, more information surfaced that could be used to achieve these objectives.

Table 1 List of interviewees

Interviewees	Number	Personal/Telephone/Email
Official: City of Cape Town (Department of Spatial Planning and Urban Design)	1	Personal
Senior Professional Officer: City of Cape Town (Development Information and GIS Department)	1	Email
Total	2	

Source: Author (2016)

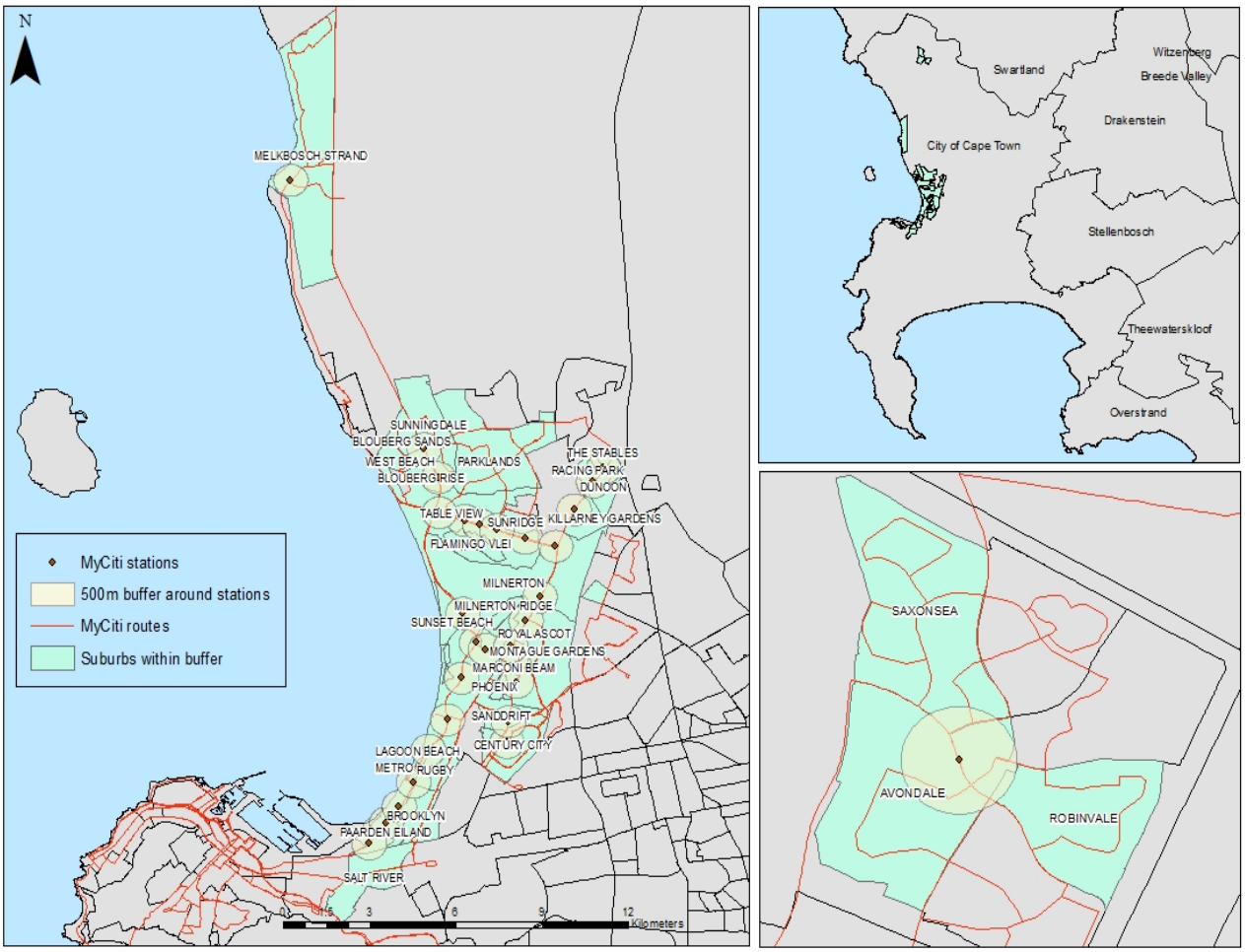
4.1. LIMITATIONS

A major limitation of this study was that densification changes are hard to identify in such a short period (six years). The latest population data that was available per suburb as was necessary for this study, was 2014 data and also only an estimation. Even though it was still useful, a more accurate study would be possible if data was available for 2016. The only population data that could be retrieved later than the 2011 Census data, was per ward. All of the population statistics that are being used are thus according to the wards. The growth in formal dwelling units that is used to study the changes in land density could however be found according to the suburbs, but there are three small suburbs that data was not available for namely Racing Park, Royal Ascot and The Stables. The growth in formal dwelling units were also only estimates.

SECTION 5: RESULTS

5.1. LOCATIONS OF THE MYCITI STATIONS

The MyCiti system currently consists of 44 routes which covers approximately 1 270 000 kilometres per month. This includes 43 stations, more than 500 bus stops and more than 215 busses in the peak-hour periods. It is a service that is too large for the purpose of this study which is why only a certain area that the MyCiti service operates in, was identified to be studied (MyCiti 2016). This area is known as the Western Corridor. The Western Corridor consists of 31 stations. A 500-meter buffer was made around each of the stations to determine the suburbs that should be studied in terms of population and density changes. After completing the buffers, it was found that 32 suburbs would be studied (Figure 2).



Source: MyCiti (2016)

Figure 2 500 meter buffer around Western Corridor stations

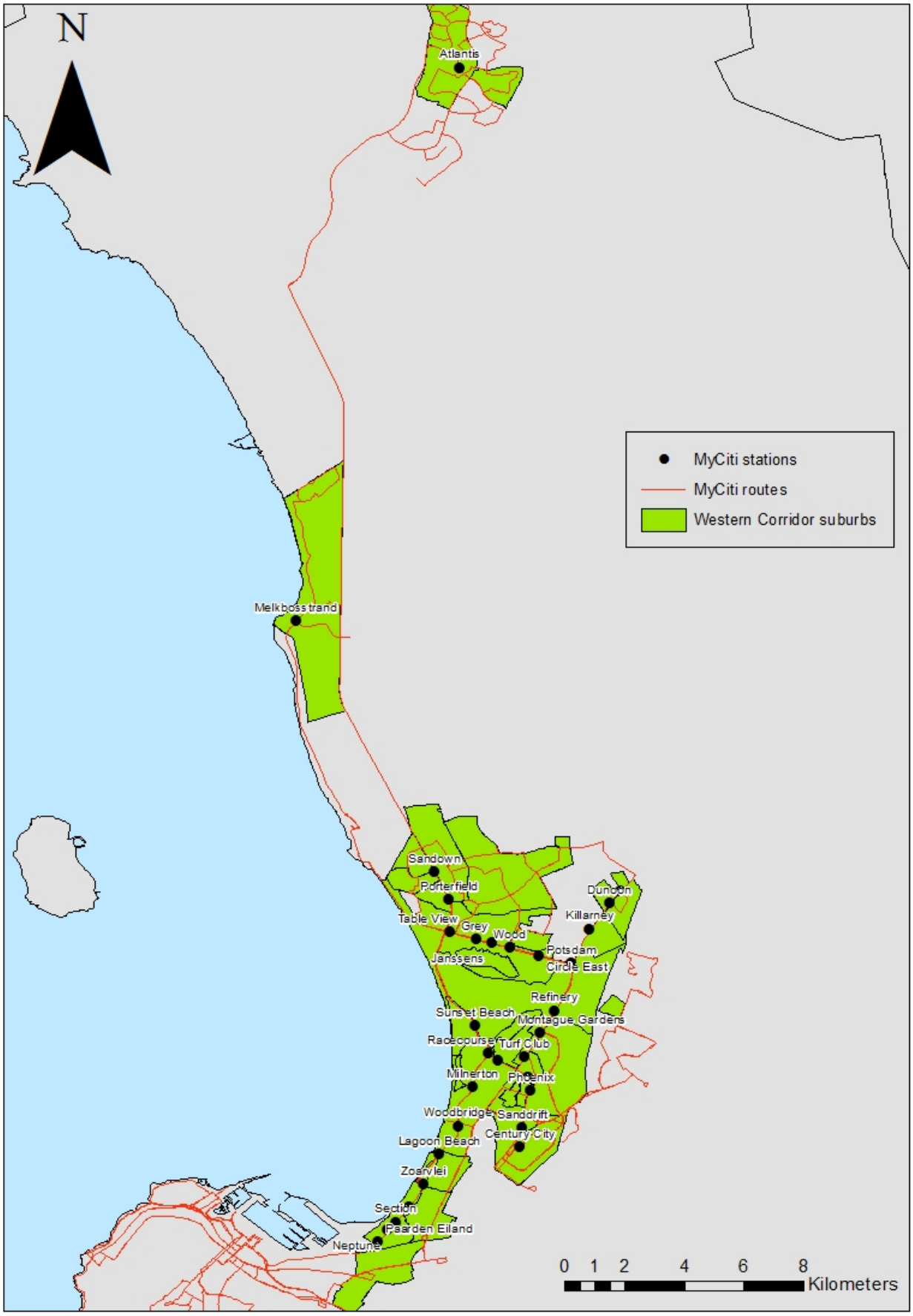
For the purpose of the population analysis, data was only available at ward level. This included eight wards consisting of the following suburbs: Avondale, Blouberg Rise, Blouberg Sands, Brooklyn, Century City, Dunoon, Flamingo Vlei, Joe Slovo Park, Killarney Gardens, Lagoon Beach, Marconi Beam, Melkbosstrand, Metro, Milnerton, Milnerton Ridge, Montague Gardens, Paarden Eiland, Parklands, Phoenix, Racing Park, Robinvale, Royal Ascot, Rugby, Salt River, Sanddrift, Saxon Sea, Sunningdale, Sunridge, Sunset Beach, Table View, The Stables and West Beach (Table 2).

Table 2 Ward division

Ward 29	**Ward 32**	**Ward 23**	**Ward 107**	**Ward 55**	**Ward 104**	**Ward 4**	**Ward 57**
Avondale	Robinvale	Blouberg Rise	Blouberg Rise	Century City	Dunoon	Killarney Gardens	Salt River
Saxon sea	Saxon Sea	Melkbosstrand	Parklands	Paarden Eiland	The Stables	Marconi Beam	
		West Beach	Table View	Phoenix	Racing Park	Milnerton	
		Blouberg Sands	Sunningdale	Brooklyn		Montague Gardens	
		Sunningdale		Lagoon Beach		Joe Slovo Park	
		Table View		Marconi Beam		Milnerton Ridge	
				Metro		Phoenix	
				Milnerton		Royal Ascot	
				Rugby		Sunset Beach	
				Sanddrift		Sunridge	
						Flamingo Vlei	

Source: City of Cape Town (2015a)

The 31 stations that are located in these suburbs can be seen in Figure 3. The stations are mostly located on or close to main roads. When only looking at the spatial distribution of the stations as seen in Figure 3, it indicates that the area is well provided for in terms of MyCiti stations. These locations do not include the MyCiti stops, which are many more.



Source: MyCiti (2016)

Figure 3 Locations of the MyCiti stations

5.2. THE CITY'S POLICY POSITION

The Spatial Development Framework of Cape Town (CTSDF) is a long-term plan that is used to manage growth and change in Cape Town. The MyCiti system is a form of public transport that has been initiated to improve various development and management issues in Cape Town as mentioned in the literature review. This initiative can contribute to the solving of various issues in the Metropolitan, but its success hinges on careful future planning of the system. The appropriate supporting infrastructure must be in place, to ensure the success of a transport system, such as the MyCiti system. Frameworks and policies must thus be implemented that will contribute to the success of the MyCiti system. The CTSDF is one of the frameworks which must plan for these circumstances (City of Cape Town 2012a).

In the CTSDF it is stated that urban sprawl must be managed. Projections suggest that the population will continue growing in the Cape Town Metropolitan, which leads to an increase in the demand for land and resources. Whether a slow or fast growing economy is coupled with the growth of population, it is still crucial to manage this growth, to most importantly, prevent sprawl. Land use planning is very important to take into consideration when public transport systems are developed and implemented. The CTSDF indicates that public transport must be provided with a logical spatial structure. This structure must ensure that land use intensification and the concentrating of economic and employment-generating land uses takes place. Land use and transport must be integrated (City of Cape Town 2012a).

5.2.1. Multidirectional accessibility grid

The CTSDF emphasises the importance of a multidirectional accessibility grid. This system must be public transport-orientated and provide a pattern of access, that enables all people to have similar access to various services, facilities and opportunities in the city. It is important to note that from a planning perspective, public transport is primarily canals of economic opportunity and only secondly, movers of people, services and goods. Accessibility is a concept that interconnects three different functions: land use proximity, transport network connectivity and system performance. The accessibility grid identifies routes which will have higher levels of accessibility in terms of land use, thus a concentration of urban development and also public transport services. When looking at a metropolitan scale, as is the case with Cape Town, two route types are identified:

- Activity routes: These are characterised by strip and/or nodal urban development along sections of the route. Activity routes are usually surrounded by a mix of land uses and higher density urban development.

- Development routes: These routes tend to have better mobility function. Mixed land use and higher-density development tend to be nodal. Access is usually provided at intersections and connected to parallel and side routes.

The multidirectional accessibility grid that Cape Town has planned lays the foundation for the routing and service design of an Integrated Public Transport Network (IPTN). The intention of the IPTN is to place over 85% of the city's population within 1 km of a high-quality public transport system. The IPTN will inform a hierarchy of public transport services connecting to the accessibility grid. This will include: A rail service that is citywide to district level, which is provided at 8-16 km intervals; a road-based trunk service that is provided for on a dedicated and semi-dedicated right of way infrastructure which offers an 18-hour frequent service along major and district-level roads and along activity and development routes; a community (feeder and distribution) service that feeds into the trunk bus and rail services, at 4-8 km intervals and pedestrian and cycle lanes that runs along the public transport routes as well as around the stops and stations, with safe and convenient access. To ensure efficient public transport and to generate accessible economic opportunities, land use intensification must be encouraged along these routes on the accessibility grid (City of Cape Town 2012a).

The CTSDF does not refer to the MyCiti system, however many of these specifications coincide with the system. The road-based trunk service that are referred to in the CTSDF is most probably referring to the MyCiti system. The MyCiti system can include activity routes and development routes and will thus form part of the multidirectional accessibility grid.

5.2.2. Strategies and policies implemented by the CTSDF with regard to public transport

The CTSDF has three key strategies. Key strategy 1: "Plan for employment, and improve access to economic opportunities", is the strategy that is most applicable to the implementation of public transport in Cape Town. The City is prioritising investment in the improvements of public transport and in support of these investments, the CTSDF has adopted an integrated approach towards land use, transport planning and economic development. Higher density forms of residential development and economic development will be encouraged in areas where public transport is in abundance. This will lead to the public transport systems in Cape Town being more efficient (City of Cape Town 2012a).

Table 3 Key Strategy 1

Substrategy	Policy No.	Policy statement
Establish an integrated, city-wide public transport system that supports the accessibility grid	P10	Create a hierarchy of integrated public transport services related to the accessibility grid
	P11	Ensure that new urban development is supported by appropriate public transport infrastructure and services
	P13	Include walking and cycling as essential components of land use planning
Integrate land use, economic and transport planning	P15	Reinforce and enhance metropolitan development corridors
	P16	Encourage medium to higher-density forms of urban development to locate on or adjacent to activity routes, development routes and activity streets

Source: City of Cape Town (2012a)

This strategy is made up of other sub strategies, of which some are more applicable to public transport than other. These policies can be seen as methods used by the City of Cape Town to ensure the efficiency of the MyCiti system. These policies focus on public transport as a whole, but seeing as the MyCiti system is currently one of the largest public transport initiatives and also a newer system, policies and planning is necessary to contribute to the success of the system. The sub strategies are categorized under the three different key strategies. Table 3 identifies five policies that are applicable to this study. These policies are focussed on integrating public transport with urban development and encouraging higher-density forms of urban development. As Grey and Behrens (2013) stated, higher density and urban development is necessary in the Western Corridor to ensure the efficiency of the MyCiti system. Thus meaning that these policies will contribute to the MyCiti system and are definitely necessary to encourage the growth of this system.

Table 4 Key Strategy 2

Substrategy	Policy No.	Policy statement
Encourage a more compact form of development	P22	Promote appropriate land use intensification

Source: City of Cape Town (2012a)

Key strategy 2: “Manage urban growth, and create a balance between urban development and environmental protection” (Table 4) is less applicable to public transport in Cape Town, but one policy has been identified that is important in terms of the development of public transport and thus to the MyCiti system. This is the encouragement of a more compact form of development, which means that a higher-density form of development is encouraged. As previously stated, this is a requisite to an efficient public transport system.

Table 5 Key Strategy 3

Substrategy	Policy No.	Policy statement
Encourage integrated settlement patterns	P39	Generally support development, rezoning, subdivision and similar applications that promote a greater mix of land uses, people and/or densities

Source: City of Cape Town (2012a)

Key strategy 3: “Build an inclusive, integrated and vibrant city” (Table 5) also includes one policy that has been identified as being able to influence the efficiency of public transport. This does not only encourage land use intensification but also the mix of land uses and densities. Land use intensification means higher density which can contribute to the success of public transport systems.

The CTSDF also have separate plans per district. The Blaauwberg District Plan of 2012 is applicable in the areas that is being studied. This plan states that the inefficient movement system must be addressed and one of the approaches are utilising the IRT system more efficiently. It is also stated that the accessibility grid must be improved by means of a number of new roads that are proposed but also by initialising the IRT system. The plan also encouraged higher density mixed-use development along major routes as a means of reinforcing public transport. The intention of the city is to encourage land use intensification along the accessibility grid which can be in a variety of forms including development corridors, urban nodes and strip development. The plan also supports the general alignment of the IRT trunk routes in the district with the accessibility grid and states that public transport infrastructure must compliment the identified land use and development of the route. If any development or redevelopment takes place in this area, it should be done with the potential IRT infrastructure improvements in mind (City of Cape Town 2012c).

The CTSDF is not explicit in facilitating ways of increasing densities around the stations and the routes of the MyCiti service (City of Cape Town 2012a). There are various policies that do encourage higher density development, land use intensification as well as different methods of improving the public transport networks but there is no specific reference to the IRT system and the higher density development that is necessary with regards to this system. The Blaauwberg District Plan of 2012 focusses more specific attention on the IRT system and encourages more development that would be favourable to the system including the facilitation of higher density development as well as mixed land use development (City of Cape Town 2012c).

5.3. HISTORY OF THE WESTERN CORRIDOR

The Western Corridor was the first route of the MyCiti System that was initiated (MyCiti 2016). During an interview with officials of the City of Cape Town’s Department of Spatial Planning and Urban Design much was revealed about the origin of this route and why this was the first route to be launched. The reasons attributed to the location of this route was firstly, the fact that the route’s approval was seen as supportive of strategic infrastructure in the 2010 Soccer World Cup event. Secondly, this specific route was chosen since it was the area with the least number of taxi stops

along the route as well as the fact that the Metrorail services does not function in those areas. Therefore, the City would have received the least number of objectives from the taxi industry and Metrorail in selecting the route along Blaauwberg Road. The time-pressure resulting from the imminent 2010 Soccer World Cup event meant that the determination of the station locations and route in the Western Corridor did not look at current building densities or potential for future densification as major considerations, that would have been ideal when a public transport system such as the MyCiti system is implemented, and as a result the main determinant for station locations was the major intersections in the area (Pers com 1 2016).

In terms of the planning and execution of the first phase of the MyCiti System, the potential effects on land use was an afterthought. Determining the locations of the stations did also not take into consideration how land use would be affected or how it could be utilized in conjunction with the MyCiti routes. This is attributed to the speedy process of attempting to deliver the first phase of the MyCiti System before the World Cup (Pers com 1 2016).

5.4. HISTORIC AND CURRENT LAND DEVELOPMENT TRENDS

Land use change may include either conversion from one type of use to another or modification of a specific type of land use. Modification of a particular land use may involve changes in the intensity of this use as well as variations of its characteristic qualities – such as changes from low-income to high-income residential areas (the buildings remaining physically and quantitatively unaltered), changes of suburban forests from their natural state to recreation uses (the area of land staying unchanged), and so on (Jones & Clark 1997).

Land use changes are hard to analyse over a short period such as in this study, as the MyCiti services were only operating since 2010, thus meaning that it has only been in operation for six years (MyCiti 2016). The land use changes could still be analysed but discussions with the City of Cape Town confirmed that not much change has occurred in terms of land use in the Western Corridor area especially specifically surrounding the stations. An area that does have all the preconditions for redevelopment is Blaauwberg Road, as the area is a little run down and one of the MyCiti trunk routes run along this road. Public Transport (PT) areas are established with the intention of getting more people to make use of transport rather than cars. In terms of the City of Cape Town's Land Use Scheme, some areas in the City can stipulate lower than usual parking requirements when development takes place, especially if these areas are associated with public transportation. Blaauwberg Road is classified as a PT2, or Public Transport Area 2, which offers the

least parking requirements. This makes the area very attractive for developers (Pers com 1 2016). In theory therefor redevelopment in this area should be quite logical. However, there are also various problems in terms of development in this area. These problems relate specifically to the following:

5.4.1. Title deed restrictions

All property in the area have title deed restrictions, which restrict the development of higher density residential land uses. Presently mostly low-key redevelopment takes place. People also buy small houses and then run illegal businesses from there. Large scale redevelopment of properties is thus not taking place since the costs involved in removing title deed restrictions on a number of consolidated properties (which will be necessary for any increase in density) are too high and the administrative burden of public consultation for such removal too tedious (Pers com 1 2016).

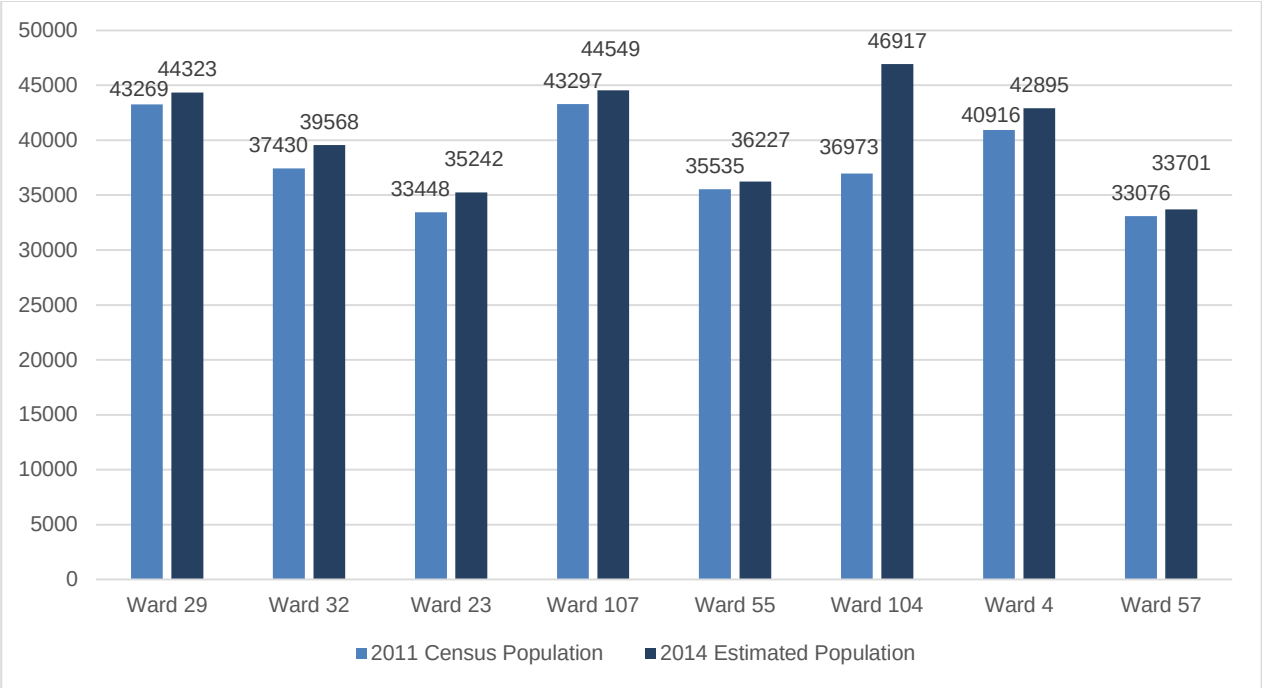
5.4.2. Access

Blaauwberg Road is a mobility route which means that only every four erven have access to the road. The plan was to build a service road in the future, so to provide every property with access to the road. However, with the development of the trunk route of the MyCiti system, the plan was to remove the Blue Gum trees on the northern side of Blaauwberg road to make space for the trunk route, but this was objected to by members of the community, meaning that the trunk route had to be widened in the direction of the planned service road i.e. the southern side (Pers Com 1 2016). There is therefore not enough space for the planned service road, leading to difficulty in providing access to Blaauwberg road to individual properties, and contributing to the inertia for redevelopment. All these factors play a prominent role in the successes and failures of the current land use pattern in support of the BRT route.

5.5. POPULATION GROWTH ANALYSIS OF THE STUDY AREA

Data from the 2011 Census is used for the purpose of this study, as the Myciti system was implemented in 2010. Thus, 2011 data is close to the implementation date and can be used to compare if growth have taken place. All of the wards showed an increase in population from 2011 to 2014. The study attempts to ascertain whether changes in population can be attributed to the implementation of the MyCiti system. Thus, it is important to note that 35% of the newcomers to the city by 2014 were from the Eastern Cape. There is a large influx of new arrivals, because of better socio-economic, health and economic circumstances that are believed to be available in the Western Cape, especially in Cape Town (Business News 2014). It is thus not possible to accredit the MyCiti system for all the population growth that can be seen in Figure 4. But the MyCiti system

could definitely have an effect on the changes in population that are being observed in these areas. The largest population growth between 2011 and 2014 is observed in Ward 104. The suburb being studied that falls within this ward is Dunoon, The Stables and Racing Park. This suburb contains an informal settlement, which can definitely attribute to the large growth in population that is taking place here, especially as many new arrivals to Cape Town situate in informal settlements (Business News 2014).

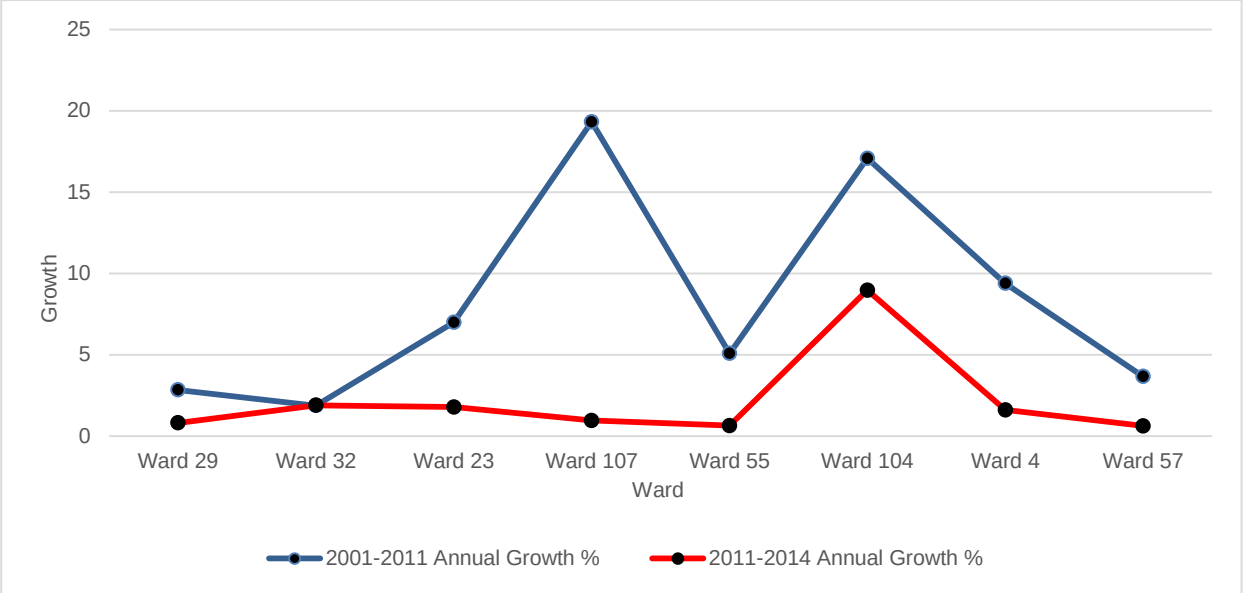


Source: StatsSA (2011); StatsSA (2014); City of Cape Town (2015a)

Figure 4 Population growth per ward after the implementation of the MyCiti system

To determine whether the population growth have changed since the implementation of the MyCiti system, it is necessary to evaluate the change in population prior to the implementation of the system. Figure 5 indicates the changes in the annual population growth between 2001 and 2011 and also after the implementation of the MyCiti system, 2011 to 2014. From Figure 5, it is evident that annual population growth was higher between 2001 and 2011 than between 2011 and 2014. It is important to consider the other factors that affected the population growth in the City of Cape Town. Between 2001 and 2011, almost 40% of the city's population growth was from in-migration from outside the province (Business News 2014). A large part of the new arrivals was among the black African population group. The government and economic opportunities in the Western Cape was on the rise in this time period and attracted many South Africans (City of Cape Town 2014). This major in-migration from other provinces could thus be one of the main reasons for the significant difference between the population growth in Cape Town between 2001 - 2011 and 2011

– 2014. One of the main contributors to the slowing down of the population growth rate is also the Aids epidemic, which has a major influence on South Africa's death rates (News24 2011).



Source: StatsSA (2011); StatsSA (2014); City of Cape Town (2015a)

Figure 5 Annual population growth per ward before and after the implementation of the MyCiti system

5.6. LAND USE DENSITY ANALYSIS OF THE STUDY AREA

As the formal launch of the MyCiti service was in May 2011, studying the changes in land use would be most effective from 2011 up until now. The estimated growth in formal dwelling units gives an indication of how much building has taken place in the various suburbs that falls within a 500-meter radius of the MyCiti stations that are situated in the Western Corridor. This is only expressed as estimated growth as the last Census was in 2011 and The Development Information and GIS Department of the City of Cape Town, has thus developed a methodology to develop estimated growth in formal dwelling units at a Census sub-place level. Using the 2011 Census and sub-place average household size as base-data and the building indicators from the Residential Growth Monitoring System (UGMS), the estimated growth in formal dwelling units from October 2011 to end December 2015 by Census sub-place (2011 Census) in Cape Town has been developed (City of Cape Town 2015b). Table 6 represents the total growth in formal dwelling units from October 2011 to December 2015. Some suburbs have experienced no growth in terms of the development of formal dwellings. These suburbs include: Blouberg Rise, Brooklyn, Killarney Gardens, Lagoon Beach, Metro, Paarden Eiland and Sunridge. This can be due to these suburbs not having any space available for development. Some suburbs also experienced a decline in the number of formal dwelling units. This can be due to space that might be necessary for other development such as roads, public transport etc. These suburbs include: Joe Slovo Park, Marconi

Beam, Montague Gardens and Salt River. The highest growth in formal dwelling units has been evident in Melkbosstrand with 280 units. Century City and Rugby also have high growth rates. Other suburbs with high growth rates include Milnerton, Milnerton Ridge, Parklands, Saxon Sea, Sunset Beach and Table View.

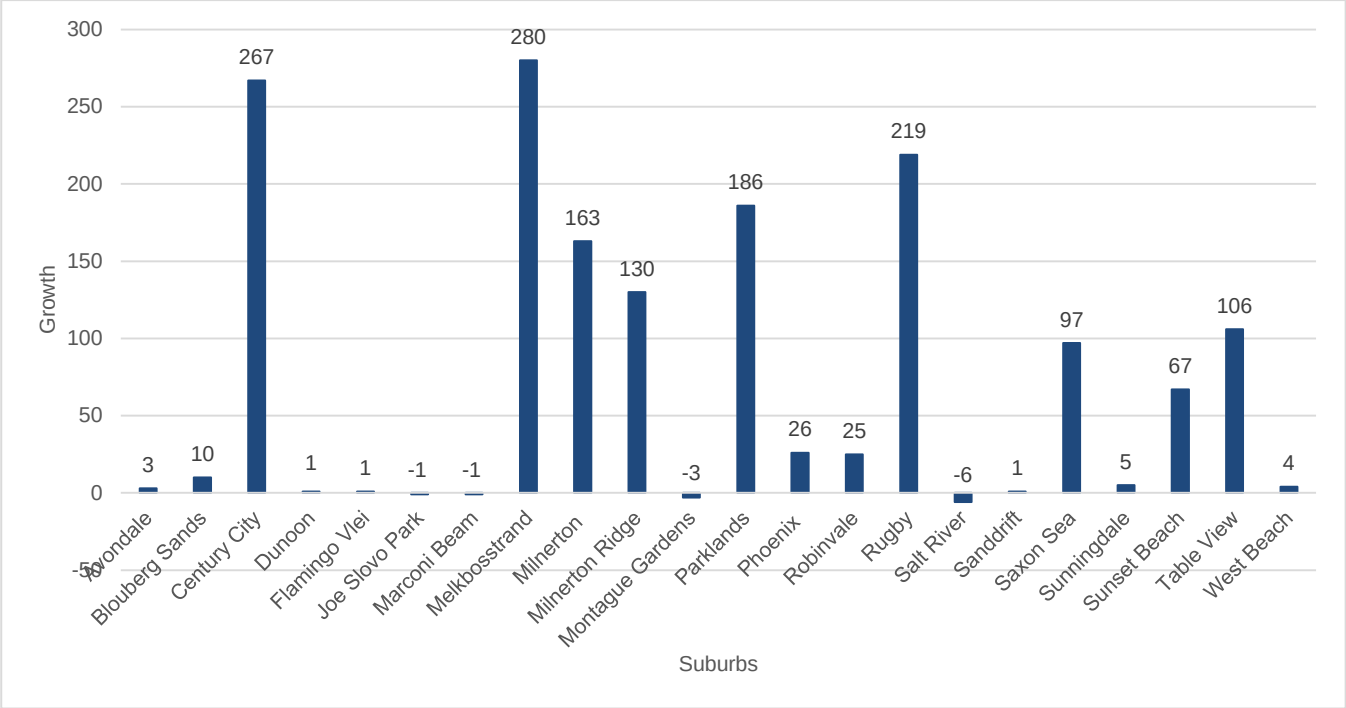
Table 6 Estimated growth in formal dwelling units

Suburbs	Total Growth: Oct 2011 - Dec 2015
Avondale	3
Blouberg Rise	0
Blouberg Sands	10
Brooklyn	0
Century City	267
Dunoon	1
Flamingo Vlei	1
Joe Slovo Park	-1
Killarney Gardens	0
Lagoon Beach	0
Marconi Beam	-1
Melkbosstrand	280
Metro	0
Milnerton	163
Milnerton Ridge	130
Montague Gardens	-3
Paarden Eiland	0
Parklands	186
Phoenix	26
Robinvale	25
Rugby	219
Salt River	-6
Sanddrift	1
Saxon Sea	97
Sunningdale	5
Sunridge	0
Sunset Beach	67
Table View	106
West Beach	4

Source: City of Cape Town (2015b)

Figure 6 represents only these suburbs that experienced growth or decline in terms of the formal dwelling units. Melkbosstrand having the highest growth in formal dwelling units of all the Western Corridor suburbs can be an indication of the MyCiti services having an influence on building density. This is a suburb that is located far away from the city, which means that a lot of travelling

is necessary when living here. But with public transport now being an option, more development takes place in this area.



Source: City of Cape Town (2015b)

Figure 6 Estimated growth in formal dwelling units from October 2011 - December 2015

It is also noteworthy that Avondale, Robinvale and Saxon Sea have a combined growth of 125 units (Figure 6). These three suburbs are located in Atlantis, and this can be a very good indication of the MyCiti station and routes leading to more building taking place in these areas located far away from the city. The growth in formal dwelling units can also be attributed to other factors, but the fact that the growth is evident in areas that are located further away from the city can be an indication of public transport affecting areas of development. This can however also mean that an increase in sprawl can be a result of public transport systems as people are now willing to live in areas that are further from the CBD, their places of work etc. But the growth in formal dwelling units in these areas where the MyCiti system has been implemented since 2010 is significant.

SECTION 5: CONCLUSIONS

Reflection in terms of the money spent on the system as well as the profitability and success of the system, reveals that retrofitting is needed in many parts of the MyCiti system. Land use and transport cannot be separated from one another and when planning for such a major transport project is done, land use cannot be an afterthought. Transport can largely affect land use and land development because of the infrastructure that goes hand in hand with transport development. There is also increased access to land, meaning that development is more likely (University of Wisconsin-Milwaukee 1999). However, as was found, land use intensification is improbable to occur instantly following the construction of public transport systems. No real land use changes have occurred thus far, however the estimated growth in formal dwelling units do show large numbers of growth in areas that are located further away from the CBD such as Melkbosstrand and Atlantis.

A very important aspect of the inefficiency of the MyCiti system is the limited amount of planning that went into the development of the system in the Western Corridor as a result of strenuous timeframes. The MyCiti routes that have been implemented in Parklands are newer, and much more planning went into the development of this route. The area also has higher residential density. One of the main reasons for implementing this route, other than transport, is with the outlook of more development happening in the area. This route is one of the most profitable MyCiti routes in Cape Town, thus showing that if time is used to plan and take into account density and land use development, then it will definitely have an impact on the success of the IRT system. The intensification of land uses around the Western Corridor is therefore dependant on retrofitting the current urban fabric, a process that is difficult to achieve especially in the absence of clear processes and programmes to initialise such transformation.

The limited explicit statements relating to land use development in policies and plans was found to be one of the factors that impacted the efficiency of the system thus far. The CTSDF and the Blaauwberg District Plan do have various policies that encourage higher density development and addresses the interaction that is necessary between public transport and development, but it is not specific enough and it is evident that these policies have yet to trickle down into targeted programmes and projects that will trigger the transformation of urban areas around the Western Corridor stations. As stated in the hypothesis, the density in Cape Town is too low for the MyCiti system to operate effectively and the increases in population in these areas have also not been significant, which indicates that the City needs to be more pro-active in the development of the system and also the development of the surrounding areas. Not all problems of underutilisation can be attributed to density. One of these is the operational issues which includes the problem of high-

usage volumes during peak-hour periods but then an empty bus makes its way back to the suburbs. This is also applicable in the other direction in the afternoon peak-hour periods (Pers com 1 2016). Another problem is the environmental constraints. A large part of the Western Corridor is not developable because of environmental regulations and a large part of the area is also located along the coast meaning that the one side of the MyCiti route is almost completely made up of beach and ocean, rendering all possibilities for intensification of activities impossible (Pers com 1 2016).

The need exists to implement large scale project-driven programmes that specifically focusses on land use intensification surrounding the MyCiti stations and routes. The implementation of these programmes must be prioritised by the City, leading to more pro-active steps being taken. The routes and stations must also be planned in accordance with the surrounding land uses, especially in terms of planning for the future MyCiti stations and routes that must still be developed. The question that also now exists is whether the more efficient the MyCiti system becomes, if it can possibly contribute to Cape Town experiencing higher levels of urban sprawl? As was found with the growth in formal dwelling units in areas located further away from the city such as in Melkbosstrand and Atlantis, it could be an indication of the willingness of people to situate themselves further away from the CBD.

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PERSONAL COMMUNICATIONS

Pers com 1 2016. Official: City of Cape Town (Department of Spatial Planning and Urban Design). Cape Town. Interview on 7 September.

Pers com 2 2016. Senior Professional Officer: City of Cape Town (Development Information and GIS Department). Stellenbosch. Communication on 31 August.

APPENDIX A

Interview template

1. When did the IRT system become a concept that was being considered for Cape Town?
2. What were the main reasons for choosing the IRT system as a form of public transport for Cape Town?
3. Why was it decided to implement the system in the Western Corridor (Blaauwberg region) first?
4. What were the main obstacles that were being faced with implementing the MyCiti System in Cape Town?
5. Was initiative taken from other countries to implement this system and if so, from where and why?
6. Was densification an issue with the implementation of the MyCiti system?
7. If so, in which ways were higher densities being enabled or facilitated?
8. Is intensification of activities at the various stations a priority to try and enable the population- and building densities in these areas?
9. Have increases in population- and building densities been noticed in these areas?
10. Can any land development patterns be identified in these areas, with specific focus on the Blaauwberg region?
11. Are there any other changes that can be identified in these areas?

APPENDIX B

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Approved with Stipulations

New Application

17-Oct-2016
Wilson, Melissa M

Proposal #: SU-HSD-003394

Title: **URBAN DENSITIES AND TRANSIT: AN ANALYSIS OF CAPE TOWN'S INTEGRATED RAPID TRANSIT SYSTEM FROM 2010 – 2016 WITH SPECIFIC FOCUS ON THE WESTERN CORRIDOR**

Dear Miss Melissa Wilson,

Your **New Application** received on **24-Aug-2016**, was reviewed
Please note the following information about your approved research proposal:

Proposal Approval Period: **03-Oct-2016 -02-Oct-2019**

The following stipulations are relevant to the approval of your project and must be adhered to:
1) PARTICIPANT SELECTION AND RECRUITMENT
The recruitment selection is not discussed in any detail, apart from mentioning "people with knowledge in the specific field of study will be asked some questions..." The reviewer can therefore not consider any possible ethical considerations in this regard. It is not clear how these "people with knowledge" will be identified. They will be approached via e-mail, but there is no indication of compliance with POPI, etc. The researcher is requested to confirm exactly how potential participants will be recruited for the interviews? [RESPONSE REQUIRED]
2) INSTITUTIONAL PERMISSION
It is likely that potential participants will be in the employ of Public Transport Operations and Department of Transport of Cape Town. If this is the case institutional permission is required and the data collection cannot continue until this is obtained. [RESPONSE REQUIRED]

Please provide a letter of response to all the points raised IN ADDITION to HIGHLIGHTING or using the TRACK CHANGES function to indicate ALL the corrections/amendments of ALL DOCUMENTS clearly in order to allow rapid scrutiny and appraisal.

Please take note of the general Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

Please remember to use your **proposal number** (**SU-HSD-003394**) on any documents or correspondence with the REC concerning your research proposal.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Also note that a progress report should be submitted to the Committee before the approval period has expired if a continuation is required. The Committee will then consider the continuation of the project for a further year (if necessary).

This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki and the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health). Annually a number of projects may be selected randomly for an external audit.

National Health Research Ethics Committee (NHREC) registration number REC-050411-032.

We wish you the best as you conduct your research.

If you have any questions or need further help, please contact the REC office at .

Included Documents:
DESC Report
REC: Humanities New Application

Sincerely,

Clarissa Graham
REC Coordinator
Research Ethics Committee: Human Research (Humanities)